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| APPLICATION NO. | FILING DATE | FIRST NAMED INVENTOR | ATTORNEY DOCKET NO. | CONFIRMATION NO. |
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| 10/809,398 | 03/26/2004 | Hiroyuki Fukuyama | 1691-0177PUS2 | 7540 |
| 2292 | 7590 | 11/29/2005 | EXAMINER | |
| BIRCH STEWART KOLASCH & BIRCH PO BOX 747 FALLS CHURCH, VA 22040-0747 | | | SONG, MATTHEW J | |
| | | | ART UNIT | PAPER NUMBER |
| | | | 1722 | |

DATE MAILED: 11/29/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

| | | | |
|------------------------------|--------------------------------------|--|--|
| Office Action Summary | Application No. 10/809,398 | Applicant(s) FUKUYAMA ET AL. | |
| | Examiner Matthew J. Song | Art Unit 1722 | |

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 06 September 2005.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-2 is/are pending in the application.
- 4a) Of the above claim(s) 3 is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-2 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☐ The drawing(s) filed on _____ is/are: a) ☐ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) Paper No(s)/Mail Date. _____ |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | 5) <input type="checkbox"/> Notice of Informal Patent Application (PTO-152) |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Election/Restrictions

1. This application contains claim 3 drawn to an invention nonelected with traverse in Paper filed 9/6/2005. A complete reply to the final rejection must include cancellation of nonelected claims or other appropriate action (37 CFR 1.144) See MPEP § 821.01.

Claim Rejections - 35 USC § 102

2. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(b) the invention was patented or described in a printed publication in this or a foreign country or in public use or on sale in this country, more than one year prior to the date of application for patent in the United States.

3. Claim 1 is rejected under 35 U.S.C. 102(b) as being anticipated by Nakamura et al (EP 0 999 640 A2).

Nakamura et al discloses a sapphire single crystal made of $\alpha\text{-Al}_2\text{O}_3$ and an initial nitriding treatment to form a very thin aluminum nitride single crystal ([0018]-[0021]).

Nakamura et al also discloses an initial nitriding treatment is performed heating a sapphire single crystal substrate to 950°C and introducing an ammonia gas together with a carrier gas consisting of hydrogen and nitrogen. Nakamura et al also discloses a very thin AlNO film is formed during this initial nitriding treatment, this reads on applicant's aluminum oxynitride layer ([0035]-[0036]).

Claim Rejections - 35 USC § 103

4. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

This application currently names joint inventors. In considering patentability of the claims under 35 U.S.C. 103(a), the examiner presumes that the subject matter of the various claims was commonly owned at the time any inventions covered therein were made absent any evidence to the contrary. Applicant is advised of the obligation under 37 CFR 1.56 to point out the inventor and invention dates of each claim that was not commonly owned at the time a later invention was made in order for the examiner to consider the applicability of 35 U.S.C. 103(c) and potential 35 U.S.C. 102(e), (f) or (g) prior art under 35 U.S.C. 103(a).

5. Claim 2 is rejected under 35 U.S.C. 103(a) as being unpatentable over Nakamura et al (EP 0 999 640 A2) as applied to claim 1 above, and further in view of Bolt (US 4,857,246).

Nakamura et al discloses all of the limitations of claim 2, as discussed previously, except Nakamura et al does not teach the substrate is nitrided by heating in the presence of carbon, nitrogen and carbon monoxide.

In a method of forming aluminum nitride by nitridation, note entire reference, Bolt teaches a stoichiometric excess of carbon ensures conversion of alumina to aluminum nitride. Bolt also teaches one mole of alumina reaction with three moles of carbon and one mole of nitrogen to produce two moles of aluminum nitride and three moles of carbon monoxide at

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temperatures above 1500°C, this reads on applicant's nitrided by heating in the presence of carbon, nitrogen and carbon monoxide (col 3, ln 1-67 and col 1, ln 40-67). It would have been obvious to a person of ordinary skill in the art at the time of the invention to modify Nakamura et al by nitriding in the presence of carbon, nitrogen and carbon monoxide, as taught by Bolt, to ensure unreacted alumina in the final product is avoided.

Double Patenting

6. The nonstatutory double patenting rejection is based on a judicially created doctrine grounded in public policy (a policy reflected in the statute) so as to prevent the unjustified or improper timewise extension of the "right to exclude" granted by a patent and to prevent possible harassment by multiple assignees. See *In re Goodman*, 11 F.3d 1046, 29 USPQ2d 2010 (Fed. Cir. 1993); *In re Longi*, 759 F.2d 887, 225 USPQ 645 (Fed. Cir. 1985); *In re Van Ornum*, 686 F.2d 937, 214 USPQ 761 (CCPA 1982); *In re Vogel*, 422 F.2d 438, 164 USPQ 619 (CCPA 1970); and, *In re Thorington*, 418 F.2d 528, 163 USPQ 644 (CCPA 1969).

A timely filed terminal disclaimer in compliance with 37 CFR 1.321(c) may be used to overcome an actual or provisional rejection based on a nonstatutory double patenting ground provided the conflicting application or patent is shown to be commonly owned with this application. See 37 CFR 1.130(b).

Effective January 1, 1994, a registered attorney or agent of record may sign a terminal disclaimer. A terminal disclaimer signed by the assignee must fully comply with 37 CFR 3.73(b).

7. Claims 1-2 are rejected under the judicially created doctrine of obviousness-type double patenting as being unpatentable over claim 3 of U.S. Patent No. 10/937,344. Although the conflicting claims are not identical, they are not patentably distinct from each other because 10/937,344 claims forming a highly crystalline aluminum nitrided by nitriding a single crystal alumina substrate in the presence of carbon, nitrogen and carbon monoxide to form aluminum oxynitride and a highly crystalline aluminum nitride film (claim 3).

10/937,344 claims forming a highly crystalline aluminum nitride film and a single crystalline aluminum nitride film. A highly crystalline aluminum nitride film anticipates a single crystalline film because a single crystalline film is a highly crystalline film.

Response to Arguments

8. Applicant's arguments filed 9/6/2005 have been fully considered but they are not persuasive.

Applicant's argument that Nakamura et al teach forming a buffer layer and an aluminum nitride layer by MOCVD is noted but is not found persuasive (pg 3). Nakamura et al teaches prior to the deposition of the buffer layer by MOCVD, an initial nitriding treatment may be conducted after hydrogen annealing, and by performing the nitriding treatment, a very thin aluminum nitride single crystal film is formed ([0021]). Nakamura et al also teaches during this initial nitriding treatment, on the surface of the sapphire single crystal substrate is formed a very thin AlNO film ([0036]). Therefore, Nakamura et al does teach forming an AlNO layer and a single crystal AlN layer by nitriding. It is also noted that as claimed, a single crystal aluminum nitride layer can be formed after the nitriding process using another method, such as MOCVD. The claim merely requires nitriding a sapphire substrate to form an AlN film, which is not required to be single crystalline, and does not specifically require a single crystalline aluminum nitride film be formed by nitriding.

Applicant's arguments that Nakamura et al teaches a buffer layer is noted but is not found persuasive. Nakamura et al teaches nitriding prior to forming the buffer layer ([0021]); therefore meets the claimed limitation.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., the aluminum nitride layer is formed directly on the AlNO film (pg 4)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993).

Applicant's argument that Nakamura teaches forming a buffer layer, thus does not teach an aluminum nitride layer formed on the AlNO film. Nakamura et al teaches nitriding a sapphire substrate and nitriding forms a aluminum nitride layer and an AlNO layer ([0021] and [0036]). Therefore, Nakamura does teach forming both AlN and AlNO on the substrate by nitriding.

In response to applicant's argument that the references fail to show certain features of applicant's invention, it is noted that the features upon which applicant relies (i.e., crystalline AlNO (pg 4)) are not recited in the rejected claim(s). Although the claims are interpreted in light of the specification, limitations from the specification are not read into the claims. See *In re Van Geuns*, 988 F.2d 1181, 26 USPQ2d 1057 (Fed. Cir. 1993). The claims do not require crystalline AlNO.

Applicant's argument that aluminum oxynitride is not formed by heating at 950°C is noted but is not found persuasive. Applicant relies on Figure 2 of the instant specification to show that AlNO does not exist at 950°C. Applicant's figure 2 is a phase diagram and does not refer to a nitriding treatment. Nakamura et al clearly teaches AlNO is formed by nitriding at 950°C. The teaching of prior art patents are assumed to be enabled.

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In response to applicant's arguments against the references individually, one cannot show nonobviousness by attacking references individually where the rejections are based on combinations of references. See *In re Keller*, 642 F.2d 413, 208 USPQ 871 (CCPA 1981); *In re Merck & Co.*, 800 F.2d 1091, 231 USPQ 375 (Fed. Cir. 1986). Nakamura et al teaches forming the AlNO layer and Bolt is relied upon solely as a teaching of heating in the presence of carbon.

Conclusion

9. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

Wu et al (US 4,992,253) teaches Al_2O_3 reacts with carbon and nitrogen to form AlN and CO (col 3-4).

Oguni et al (US 4,917,877) teaches Al_2O_3 reacts with carbon and nitrogen to form AlN and CO (col 2).

10. **THIS ACTION IS MADE FINAL.** Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event,

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however, will the statutory period for reply expire later than SIX MONTHS from the mailing date of this final action.

11. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Matthew J. Song whose telephone number is 571-272-1468. The examiner can normally be reached on M-F 9:00-5:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Duane Smith can be reached on 571-272-1166. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

MJS
November 18, 2005

Matthew J Song
Examiner
Art Unit 1722



ROBERT KUNEMUND
PRIMARY EXAMINER